knowledge of the physiology of the cell, and the sections devoted to this subject have been carefully revised for the new edition now available.

WITH the advance of scientific education in this country scientific instrument makers are continuously bringing out improved forms of apparatus. We have recently received from Messrs. Brewster, Smith and Co. an improved form of a "double surface condenser." This is one of the most compact and efficient condensers which has come before our notice. We have tested it for condensing such volatile substances as ether, carbon disulphide, and acetone, and have found that even with rapid distillation the condensation is very complete. Generally speaking, in order to condense these substances satisfactorily, it is necessary to employ a very long condenser; of course, this means using a great amount of bench space. As the new condensers are used in a perpendicular position, the saving in space is very great.

MESSRS. BREWSTER, SMITH AND CO. have also sent us a "new Bunsen burner and midget furnace." It can hardly be said that the Bunsen burner is new, but the combination of furnace and burner is very convenient. The makers claim that marble is reduced to quicklime in ten minutes. This will, of course, to a large extent depend upon the quantity of marble taken in the first place—we find that from one to one and a half grms. is readily reduced to quicklime in twenty minutes. These little furnaces are not only useful for reducing calcium carbonate to lime, but also work very well in fusion experiments.

THE measurements by Biltz and Preuner of the density under different pressures of sulphur-vapour at 448° have usually been regarded as indicating that the vapour is composed of S_8 and S_2 molecules, and that the molecule S_6 does not exist. The application to the isothermal of the law of mass-action, discussed by Preuner in the *Zeitschrift für physikalische Chemie*, shows that this theory is inadequate, and that the vapour must contain molecules intermediate in complexity between S_8 and S_2. The proportions by volume of the constituents are calculated to be, under 10·4 mm. pressure, 29·2 per cent. S_8, 19·0 S_6, 19·7 S_4 and 32·1 S_2, and under 453·4 mm. pressure, 77·8 S_8, 15·1 S_6, 4·7 S_4 and 2·4 S_2.

SINCE Beckmann showed that iodine in all solvents has the molecular weight I_2, it has been suspected that the formation of violet or brown solutions is dependent upon the extent to which the iodine combines with the solvent. By means of comparative experiments on the solubility of iodine and the periodide $N(CH_3)_4I_9$, described in a recent number of the *Zeitschrift für physikalische Chemie*, Strömholm has obtained evidence that iodine actually combines with water, alcohol and ether, forming brown solutions, whilst the violet solutions in carbon disulphide, benzene and chloroform contain uncombined iodine; similarly it is shown that iodine has little tendency to combine with methyl iodide when dissolved in ether, or with sulphur dissolved in carbon disulphide.

THE additions to the Zoological Society's Gardens during the past week include a Black Lemur and young (*Lemur macaco*) from Madagascar, a Brazilian Hare (*Lepus brasiliensis*) from Brazil, eight Hamsters (*Cricetus frumentarius*), a Snow Bunting (*Plectrophenax nivalis*), four Lacertine Snakes (*Coelopeltis monspessulana*), two Dark-green Snakes (*Zamenis gemonensis*), a Vivacious Snake (*Tarbophis fallax*), European; three Cuban Snakes (*Liocephalus andreae*) from Cuba, two Garter Snakes (*Tropidonotus ordinatus*), a Prickly Trionyx (*Trionyx spinifer*) from North America, a South Albemarle Tortoise (*Testudo vicina*) from Galapagos, a Wrinkled Terrapin (*Chrysemys scripta rugosa*) from the West Indies, two Amboina Box Tortoises (*Cyclemys amboinensis*) from the East Indies, two Annulated Terrapins (*Nicoria annulata*) from Western South America, a Horned Lizard (*Phrynosoma cornutum*) from Mexico, a Carinated Lizard (*Liocephalus carinatus*) from the West Indies, two Hispid Lizards (*Agama hispida*) from South Africa, two Scoresby's Gulls (*Leucophoeus scorebii*) from Chili, deposited; a Tasmanian Devil (*Sarcophilus ursinus*) from Tasmania, received in exchange.

OUR ASTRONOMICAL COLUMN.

SEARCH-EPHEMERIS FOR COMET 1896 v.—A further portion of the search-ephemeris for Giacobini's comet (1896 v.), published by Herr M. Ebell in No. 3898 of the *Astronomische Nachrichten*, is given below. As will be seen from this ephemeris the computed brightness is now decreasing, although the comet should be in a favourable position for observers in the northern hemisphere:—

12*h*. *M. T. Berlin.*

1903	α h. m. s.	δ ° ′	log *r*	log Δ	Brightness.
Oct. 28	3 54 51	+ 8 6·5	0·2943	0·0130	2·21
Nov. 1	3 51 18	+ 7 23 8			
,, 5	3 47 33	+ 6 43·7	0·3055	0·0242	1·99
,, 9	3 43 40	+ 6 7·0			
,, 13	3 39 46	+ 5 34·0	0·3165	0·0410	1·75
,, 17	3 35 56	+ 5 5·3			
,, 21	3 32 15	+ 4 40·9	0·3274	0·0633	1·51
,, 25	3 28 50	+ 4 21·2			
,, 29	3 25 44	+ 4 6·0	0·3381	0·0901	1·27

A NOVEL FEATURE FOR GEODETICAL INSTRUMENTS.—In a paper contributed to No. 26, vol. iii., of the *British Optical Journal*, Sir Howard Grubb describes a novel feature in geodetical instruments which replaces the half-silvered, half-plain piece of glass generally used in such instruments by a piece of glass having a thin film of lead sulphide deposited on its surface. This film both reflects and transmits the incident light, and by varying its thickness the proportion of transmitted to reflected light may be varied.

Taking the case of the prismatic compass as an illustration, the rays of light from the object the position of which is to be determined are transmitted by the film of lead sulphide, and, at the same time, the previously collimated rays from the compass card are reflected by it. As both sets of rays are parallel, and the reflection of the card is superimposed on the image of the distant object, parallax does not interfere in the observations, and the position of the eye may therefore be changed without introducing any error into the reading, thereby rendering it possible to make the readings much more quickly and accurately than when using the older forms of reflecting-transmitting apparatus.

THE PATH OF COMET 1894 I. (DENNING).—No. 2 of the *Mitteilungen* of the Heidelberg Observatory contains a paper by Dr. P. Gast on the observations and calculations of the path of comet 1894 I.

The first part is devoted to a series of new observations of the comparison stars made during the year 1902, and is followed by a collection of the observations of the comet which were made at various observatories, then the various observations are compared among themselves and with the computed elements of this comet. The paper concludes with a discussion of the perturbations produced by Jupiter and the finally deduced elements. In a supplementary list the positions of eighty-eight reference stars for the year 1900 are given, the value of the precessional constant, the secular variation, and the star's proper motion being stated in each case.

OBSERVATIONS OF MARS.—In the October number of the *Bulletin* de la Société astronomique de France, MM. Flammarion and Benoit publish the results of their observations of Mars made at Juvisy during the last opposition of that planet. Although the planet was nearer to the earth during this opposition than it was in 1901, the unfavourable meteorological conditions prevented the making

of a complete record, but the set of fourteen drawings of the polar cap which accompany the paper show very clearly the diminution of the cap from October 15, 1902, to March 15, 1903, and its augmentation from then until July 1, the minimum apparently taking place at an earlier date than usual.

In addition to detailed descriptions of the most interesting observations, the paper contains reproductions of ten excellent drawings showing various features on the planet's surface.

NATAL GOVERNMENT OBSERVATORY.—The report of the Government Astronomer for Natal, Mr. E. Nevill, for 1902 is chiefly devoted to the various meteorological records of the colony, and forms a valuable addition to the meteorology of last year.

After giving brief descriptions of the staff, the instruments, the management of the time signals, the magnetic observations, and the tide records, the report gives a number of tables containing very complete records of the meteorological results obtained at the Durban Observatory and twenty-two inland stations, and the less complete records of twenty-six subsidiary stations which are scattered throughout the colony.

In dealing with this section of the report Mr. Nevill directs special attention to the importance of obtaining the fullest possible records of the meteorological conditions in Natal, because, in addition to their local importance, it has been shown that there is a very close connection between them and the conditions obtaining in Australia and India. In the latter case there are trustworthy indications that the meteorological conditions of Natal are those which are likely to prevail in India during the following season; this is especially marked in the case of the rainfall.

INHERITANCE OF PSYCHICAL AND PHYSICAL CHARACTERS IN MAN.[1]

THERE are probably few persons who would now deny the immense importance of ancestry in the case of any domestic animal. A majority of the community would probably admit also that the physical characters in man are inherited with practically the same intensity as the like characters in cattle and horses.

But the preeminence of man in the animal kingdom is justly attributed, not to his physical, but to his psychical character. The latter is seen developing apparently under the influences of home and of school, and we conclude, perhaps too rashly, that home and school are the chief sources of the psychical qualities. We are too apt to overlook the possibility that the home standard is itself a product of stock, and that the relative gain from education depends in a surprising degree on the raw material presented to the educator.

It is possible to hold this view and yet believe that moral and mental characters are inherited in either a qualitatively or a quantitatively different manner from the physical characters. Both may be influenced by environment, but one in a far more marked way than the other.

Some six or seven years ago, then, I set myself the following problem: What is the quantitative measure of the inheritance of the moral and mental characters in man, and how is it related to the corresponding measure of the inheritance of the physical characters?

The problem really resolved itself into three separate investigations:—

(*a*) A sufficiently wide inquiry into the actual values of inheritance of the physical characters in man.

For this investigation upwards of 1000 families were measured, giving ample means of determining the quantitative measure of resemblance for both parental and fraternal relationships.

(*b*) A comparison of the inheritance of the physical characters in man with those in other forms of life.

No substantial difference in this inheritance has been discovered.

(*c*) An inquiry into the inheritance of moral and mental characters in man.

Owing to the great difficulty of comparing the moral characters of a child with those of its adult parents, I confined my attention to *fraternal* resemblance, for if fraternal resemblance for moral and mental characters is less than, equal to, or greater than its value for physical characters, the same must be true for parental inheritance.

In the next place it seemed impossible to obtain moderately impartial estimates of the psychical characters of *adults*. The inquiry, therefore, was limited to *children*, so that the partial parent or relative could be replaced by the fairly impartial school teacher.

After much consideration and some experimenting, schedules were prepared in which teachers could briefly note the chief characteristics of the children under their charge. These schedules were white for a pair of brothers, pink for a pair of sisters, and blue for a brother and sister. With the schedules specially devised headspanners were distributed, directions for the use of the headspanner, and general directions as to the estimation of the physical and mental characters.

The material took upwards of five years to collect. Appeal was made through the columns of the educational journals to teachers of all kinds, and the observations were made not only in the great boys' public schools and the grammar schools of the country, but in modern mixed schools, in national and elementary schools of all kinds, in board schools, and private schools throughout the kingdom. Some 6000 schedules were distributed, and between 3000 and 4000 returned with more or less ample data. I have most heartily to thank the masters and mistresses of some 200 schools in which observations have been made for me. In the midst of arduous professional claims on their time and energy, they have, in many cases at considerable personal inconvenience, recorded and measured the children in their charge for a purpose only dimly foreshadowed for them.

Much of what I have to say upon the nature of the theory applied will not be new to those who have examined recent biometric work, and some of it will not be intelligible except to the trained mathematician. Still we must strive in broad lines to see how the work has been done, and, above all, to justify our treatment of the psychical character.

[To illustrate the method the lecturer examined the degree of resemblance between the cephalic indices of brothers, the cephalic index of a person being 100 × the ratio of breadth to length of head. This scarcely changes with growth after the first two years of life. A table was exhibited showing the cephalic index for 1982 pairs of brothers.]

Taking the boys, for example, with cephalic indices between 74 and 75, these boys had seventy-eight brothers who were distributed according to the column headed 74 to 75. Brothers are not alike in cephalic index, but distributed with a considerable range of variation. The arithmetic mean of the cephalic indices of this array of brothers is 77·45. Thus the average brother of a boy with cephalic index 74·5 has a cephalic index = 77·45. This is the phenomenon of regression towards the general population mean (78·9) discovered by Francis Galton.

We now find by taking all the arrays that whatever the cephalic index of first brother be, cephalic index of mean second brother

$$= (1-\alpha)\{\text{mean cephalic index of whole population}\} + \alpha\{\text{cephalic index of first brother}\}$$

and that in the case of cephalic indices for two brothers the quantity α, defined as the "resemblance," has the value 0·5.

Now from this result we have learnt two great features about inheritance in man. Firstly, that part of the cephalic index of the second brother depends in the above linear manner on that of the mean of the whole population and part on that of the first brother; and, secondly, that these parts are about equal. Are these true for other characters than the cephalic index? Undoubtedly, for all physical characters. And further, the fraction α, which we have called the resemblance, is, for brethren, in all cases about 0·5.

This surprising uniformity in the inheritance of the measurable physical characters can be extended to physical characters not capable of accurate measurement, and to psychical characters provided we assume a certain distribution of frequency for such characters in human popu-

[1] Abstract of the Huxley Memorial Lecture for 1903. Delivered before the Anthropological Institute on October 16, by Prof. Karl Pearson, F.R.S.